

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

SURFACE ROUGHENING

(Ac.)

CODE 609

DEFINITION

Performing tillage operations that create random roughness of the soil surface.

PURPOSES

- Reduce wind erosion
- Reduce dust emissions into the air
- Reduce deposition of soil into surface water
- Protect plants from abrasion by wind blown particles.

CONDITIONS WHERE PRACTICE APPLIES

On soils that have a surface layer suitable for clod formation and have a high potential for wind erosion due to lack of surface cover. This practice should not be used as a primary erosion control practice.

This practice applies on soils whose surface layer has a wind erodibility factor (I) of 104 or less. The 104 "I" factor is an irrigated value developed to account for the decreased erodibility of a 134 "I" value soil under irrigation (see the National Agronomy Manual, Exhibit 502-2).

CRITERIA

Criteria Applicable To: Reducing Wind Erosion; Reducing Dust Emissions; And Reducing Soil Deposition Into Surface Water

Tillage operations done for this purpose will produce random roughness (RR) values

(inches) large enough to achieve a 25% reduction in the potential erosion rate (soil "I" value), **OR** reduce wind erosion during the management period by 25% as determined by the most current wind erosion technology.

The random roughness subfactor (K_{rr}) shall be determined from **Table 1**. Random roughness subfactors (K_{rr}) shall be equal to or less than 0.75.

Table 1. K_{rr} from Random Roughness (RR) and "I" Factor Values¹

RR (in)	I = 104	I = 86	I ≤ 56
	RR Subfactors (K_{rr})		
0.2"	1.0	1.0	1.0
0.4"	0.95	0.86	0.70
0.6"	0.88	0.76	0.51
0.8"	0.82	0.68	0.40
1.0"	0.78	0.62	0.34
1.2"	0.74	0.57	0.30
1.4"	0.72	0.54	0.27
1.6"	0.69	0.51	0.24

¹Note—"I" factor values >134 have a $K_{rr} = 1.0$, & soils with "I" 134 will not reach a 25% reduction at any random roughness (RR) (NAM, pg. 502-47, Exhibit 502-6 or Table 502-6).

Random Roughness (RR) values for tillage operations are contained in **Table 2**.

Select the RR value for the tillage operation from Table 2. Determine the "I" factor for the soil. Using Table 1, find the RR value of the tillage operation in the column on the left and follow across the table until it crosses the "I" factor column for the soil. This is the K_{rr} subfactor. It must be equal to 0.75 or less.

Emergency tillage (surface roughening) can be done on soil that has an "I" factor greater than

104 using deep tillage, when soil moisture is adequate to create a stable aggregate (clod) and when finer soil material can be brought to the surface. Soil scientist approval is required when modifying "I" factors under these conditions.

Perform the initial tillage operation as soon as erosion starts, or as soon as it is evident that the existing cover or surface roughness is inadequate to control erosion below an acceptable level.

Begin surface roughening operations on the windward (up wind) edge of the field.

Ridging associated with the tillage is very important to controlling wind erosion. Tillage that creates ridging will be done perpendicular to the direction of damaging wind.

Surface roughening will comply with all federal, state, and local laws and regulations.

Criteria to Protect Plants from Abrasion by Wind Blown Soil Particles

Surface crusts generally reduce soil erodibility. However, certain smooth, crusted soils with loose grains (sand size particles) on the soil surface may cause crusts to abrade rapidly. These soils include loamy fine sands and sandy loams that have significant portions of sand on the surface when crusted. They also include certain calcareous loams, silt loams, and silty clay loams that tend to form sand sized aggregates in the surface when crusted.

Tillage operations for this purpose will produce random roughness sufficient to reduce or eliminate surface creep (roller phase) and saltation during crop emergence and early crop development. The random roughness created will temporarily reduce the abrasion of sensitive crops. Rotary hoes, sand fighters or similar implements, can create this roughness.

CONSIDERATIONS

This practice should be used when a well-planned and properly applied wind erosion control system fails for reasons beyond the

control of the producer. These situations may exist when a low residue-producing crop is harvested too late in a growing season to produce sufficient residue cover, or when the planned erosion control system fails to control erosion during a high wind event.

Wide spacing of chisel points or skip chiseling (alternate chiseled/non-chiseled strips) for the first operation may permit salvaging part of a growing crop of small grain and leave undisturbed soil for later operations, if needed.

Spacing and depth of chisel operation are important to obtain uniform distribution of clods on the surface. Close spacing at shallow depths generally pulverizes the soil, and does not produce enough random roughness to decrease the soil-blowing potential.

Proper tillage equipment matched to the crop being grown and soil is important. In general, chisels or narrow sweeps may reduce potential soil blowing on loamy or fine textured soils. Roughening the soil surface with a lister/bedder or wide shovels on chisel shanks is more effective on coarse textured soils.

PLANS AND SPECIFICATIONS

Plans and specifications for establishment of this practice shall be prepared for each field or treatment unit according to the conditions and criteria in this standard. Specifications shall be recorded using approved specification sheets, job sheets, narrative statements in the conservation plan, or other acceptable documentation.

OPERATION AND MAINTENANCE

This practice will be performed as soon as possible when there is inadequate cover to protect the soil from potential wind erosion events, or when a crusted soil condition occurs as sensitive crop is emerging and inadequate crop residues are present.

TABLE 2
ESTIMATED RANDOM ROUGHNESS FOR TILLAGE OPERATIONS

609 - 3

Operation	Random Roughness (RR) (inches)
Aerator, field surface, ground driven	0.40
Bedder/Hipper/Lister 5"x30"	0.80
Bedder/Hipper/Lister 5"x40"	0.80
Bedder/Hipper/Lister 8"x30"	0.80
Bedder/Hipper/Lister 8"x36"	0.80
Bedder/Hipper/Lister 8"x40"	0.80
Chisel, straight points	1.00
Chisel, sweeps, 9-16" sp	0.70
Chisel, twisted points, 18" sp	1.90
Chisel, twisted points, 30" sp	1.80
Chisel-disk, straight points	1.00
Chisel-disk, twisted points	1.50
Chisel-disk-harrow, Do-All	0.80
Chisel-disk-harrow-packer (comb)	0.50
Cultivator, field, spike	0.70
Cultivator, field, sweeps, 9"-16"	0.60
Cultivator, rowcrop, 1 in ridge	0.60
Cultivator, rowcrop, ridge till	0.50
Disk, offset, heavy	0.50
Disk, tandem, finishing	0.50
Disk, tandem, heavy, primary op.	1.20
Disk, tandem, secondary op.	0.50
Drill or Air seeder, chisel or hoe opener	0.50
Drill or Air seeder, DD opener	0.35
Drill or Air seeder, DD, w/fert opener	0.40
Drill or Air seeder, DD, w/fluted coulters	0.30
Drill or Air seeder, hoe, hvy residue	0.50
Drill or Air seeder, single disk openers	0.30
Drill, air seeder, sweep/band opener	0.60
Drill, deep furrow, 14 in sp	0.50
Drill, hvy, direct seed, DD opener	0.40

Operation	Random Roughness (RR) (inches)
Drill, hvy, direct seed, DD, w/rowcleaner	0.40
Drill, semi-deep furrow	0.40
Fertilizer applicator, anhyd, knife	0.50
Fertilizer applicator, heavy shank	1.00
Furrow Diker, row crop	0.50
Harrow, rotary, spike	0.40
Harrow, spike tooth	0.30
Harrow, spring tooth	0.40
Harrow, tine tooth	0.30
Harrow, tine, on beds	0.30
Harvest, root crop	0.20
Manure Injector, knife, 30" spacing	0.80
Mulch treader, backward	0.30
Mulch treader, forward	0.40
Para-plow or Para-till	0.70
Planter, DD opener, 18 in sp	0.40
Planter, DD opener, 30 in sp	0.40
Planter, DD opener, 36 in sp	0.40
Planter, DD opener, 40 in sp	0.40
Planter, DD opener, w/fluted coulters	0.40
Planter, ridge-till or bedded 5x30	0.40
Planter, ridge-till or bedded 5x40	0.40
Planter, ridge-till or bedded 8x30	0.40
Planter, ridge-till or bedded 8x36	0.40
Planter, ridge-till or bedded 8x40	0.40
Planter, small seed, row crop	0.24
Planter, strip-till, fluted coulters	0.40
Planter, transplanter	0.30
Plow, disk	1.10
Plow, moldboard, conventional	1.00
Plow, reversible plow (switch)	0.50

TABLE 2
ESTIMATED RANDOM ROUGHNESS FOR TILLAGE OPERATIONS

Operation	Random Roughness (RR) (inches)
Rodweeder, plain, early	0.40
Rodweeder, plain, late	0.25
Roller-Harrow, center cultivator	0.30
Rotary Hoe	0.40
Rototiller, field	0.40
Sand fighter	0.40
Sprig harvester	0.40

Operation	Random Roughness (RR) (inches)
Sprig planter	0.40
Subsoiler, 16-24 inch spacing	1.00
Subsoiler, 30-36 inch spacing	1.00
Subsoiler-bedder, (ripper/hipper)	1.00
Sweep plow, 20-40 in sp	0.40
Sweep plow, wide, >40 in sp	0.40
Sweep plow, wide, w/treader	0.30